JACC
VOL. 85, NO. 22, 2025
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PUBLISHED BY ELSEVIER

GUIDELINE COMMENTARY

Mechanical Circulatory Support in Acute Myocardial Infarction–Cardiogenic Shock

2025 Acute Coronary Syndrome Guideline in Context

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Cardiogenic shock (CS) complicates 5% to 10% of acute myocardial infarctions (AMIs) with short-term mortality of 40% to 50%.[1] Temporary mechanical circulatory support (MCS) devices are used frequently in AMI-CS to support the failing heart; however, the evidence regarding their use has been limited. Enrolling patients in AMI-CS randomized clinical trials (RCTs) has been difficult given the urgency for revascularization in ST-segment elevation myocardial infarction (STEMI), ethical and consent challenges, and hesitancy of physicians to randomize patients when MCS devices are already available. Nonetheless, multiple important RCTs of MCS have been completed outside of the United States in recent years and now inform several major recommendation changes in the 2025 ACS guideline.[1] In this commentary we summarize the guideline changes and put them in context. (See **Figure 1** for a summary of the evolution of guideline recommendations for MCS devices in AMI-CS, important RCT considerations, and key unanswered questions.)

IABP: AN OVERDUE DOWNGRADE

Routine intra-aortic balloon pump (IABP) use in AMI-CS has been downgraded from Class 2; Level of Evidence: A in the 2013 STEMI guideline[2] to Class 3 (no benefit). This change was based on the IABP-SHOCK II (Intraaortic Balloon Pump in Cardiogenic Shock II) trial,[3] which showed no mortality benefit at 30-day nor at 6-year follow-ups.[4] Routine IABP use in AMI-CS has carried a Class 3 recommendation in Europe since 2014,[5] whereas the U.S. guideline remained unchanged. Significant decreases in IABP use occurred in Europe after publication of IABP-SHOCK II and the 2014 European Society of Cardiology guideline;[6] however, decreases in the United States have been modest.[7,8] A 2015-17 NCDR (National Cardiovascular Data Registry) report showed that among the 43% patients receiving MCS for AMI-CS, 70% had an IABP.[8] Whether this guideline change will now lead to greater decreases in the United States will be important to monitor in registries like the NCDR. These devices remain reasonable to place (Class 2; Level of Evidence: A) in AMI-CS with mechanical complications.

VA-ECMO: NO BENEFIT TO EARLY USE

Prior guidelines did not provide recommendations for veno-arterial extracorporeal membrane oxygenation (VA-ECMO) in AMI-CS due to a lack of high-quality

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received April 4, 2025; revised manuscript received April 11, 2025, accepted April 14, 2025.

ISSN 0735-1097/$36.00 https://doi.org/10.1016/j.jacc.2025.04.025

SHOUT
SHARE
IT

ABBREVIATIONS AND ACRONYMS

AMI = acute myocardial infarction

CS = cardiogenic shock

IABP = intra-aortic balloon pump

mAFP = micro-axial flow pump

MCS = mechanical circulatory support

RCT = randomized clinical trial

STEMI = ST-segment elevation myocardial infarction

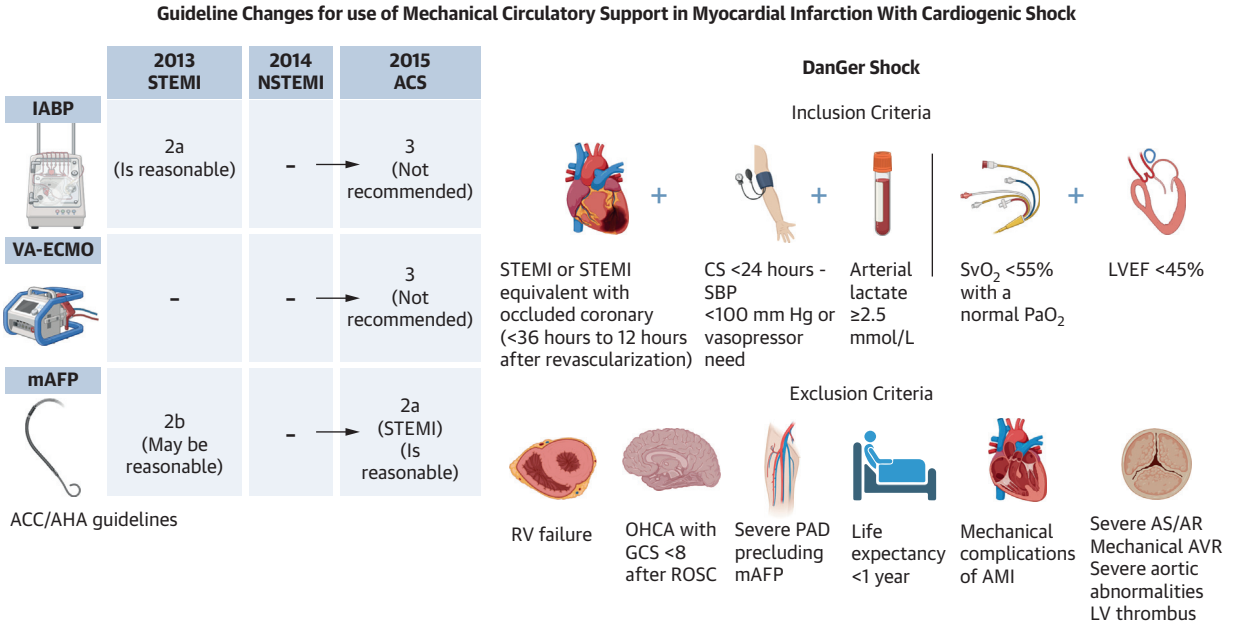
VA-ECMO = veno-arterial extracorporeal membrane oxygenation

evidence. However, in the past 3 years, this evidence gap has been addressed with the ECMO-CS (Extracorporeal Membrane Oxygenation in the Therapy of Cardiogenic Shock)[9] and ECLS-SHOCK (Extracorporeal Life Support in Cardiogenic Shock)[10] trials. Whereas both RCTs demonstrated no mortality difference with early VA-ECMO at 30 days or 1 year, ECLS-SHOCK found higher ischemic limb and bleeding complications.[11] Given these findings, the updated guideline now provides a Class 3 (no benefit) recommendation. However, with deteriorating shock, VA-ECMO remains a salvage MCS modality; the new recommendation only suggests against its routine use.

mAFP: UPGRADE IN SELECTED PATIENTS WITH STEMI

Use of micro-axial flow pump (mAFP) received an upgraded Class 2; Level of Evidence: A (is reasonable) recommendation for "selected" STEMI patients with severe or refractory CS—a change from a Class 2; Level of Evidence: B recommendation in the 2013 STEMI guideline. Although mAFP use in AMI-CS has increased in recent years,[8] until DanGer Shock (Danish Cardiogenic Shock Trial),[12] there was scant evidence supporting their use. DanGer Shock showed that routine use of the Impella CP (Abiomed) mAFP in STEMI-CS reduced 180-day mortality compared with standard care (45.8% vs 58.5%). This was, however, associated with

FIGURE 1 Guideline Changes for Use of MCS in MI With CS



Unanswered questions and future direction:

- Would VA-ECMO or IABP have benefit if applied to DanGer Shock-like patients?
- When and how to best use combined MCS modalities in managing CS?
- Physicians and critical care teams need expertise in mAFP management to mitigate risks and optimize benefit.
- Implementation-based research needed to evaluate real-world outcomes and develop best practices.

This figure summarizes key changes in the 2025 American College of Cardiology/American Heart Association (ACC/AHA) guideline recommendations for mechanical circulatory support (MCS) in acute myocardial infarction (AMI)-related cardiogenic shock (CS), including downgrades for intra-aortic balloon pump (IABP) and veno-arterial extracorporeal membrane oxygenation (VA-ECMO), and a conditional upgrade for micro-axial flow pumps (mAFPs) based on DanGer Shock (Danish Cardiogenic Shock Trial). The figure also highlights inclusion/exclusion criteria from DanGer Shock and outlines open clinical and implementation questions that remain.
ACS = acute coronary syndrome; AR = aortic regurgitation; AS = aortic stenosis; AVR = aortic valve replacement; GCS = Glasgow Coma Scale; LVEF = left ventricular ejection fraction; NSTEMI = non-ST-segment elevation myocardial infarction; OHCA = out-of-hospital cardiac arrest; PAD = peripheral artery disease; ROSC = return of spontaneous circulation; RV = right ventricle; SBP = systolic blood pressure; STEMI = ST-segment elevation myocardial infarction.

increased adverse events, including bleeding, limb ischemia, and renal replacement therapy.

Experts have debated whether the mortality benefit of mAFP in DanGer Shock was driven by its favorable hemodynamic profile compared to other MCS devices (more ventricular support than IABPs and more ventricular unloading than VA-ECMO) or the stringent trial selection criteria. DanGer Shock only enrolled patients with STEMI-CS. CS was defined as a systolic blood pressure <100 mm Hg and/or need for vasopressors, along with signs of hypoperfusion—arterial blood lactate ≥2.5 mmol/L and/or SvO_2 <55%. Patients with right ventricular failure or a Glasgow Coma Scale <8 were excluded; Glasgow Coma Scale has much stricter criteria than other MCS trials, which excluded only severely comatose patients or those with long resuscitation times. DanGer Shock took >10 years to enroll despite a mid-trial expansion, emphasizing the narrow selection criteria and challenges of conducting RCTs in this population.

As the first MCS trial to show a mortality benefit in AMI-CS, albeit only a 360-patient trial, DanGer Shock is likely to influence practice, and the guideline update will spur further adoption. However, physicians must understand the trial's enrollment criteria when translating this evidence into practice to ensure that appropriate patients are selected. To reinforce these specific selection criteria, the new guideline recommendation includes the phrase "selected* patients with STEMI" with a link summarizing the criteria.

A recent study showed that two-thirds of "real-world" STEMI-CS patients would not meet DanGer Shock criteria.[13] Whether mAFP would benefit these patients remains unknown, and use outside the inclusion criteria should therefore remain judicious. At present, no further trials are planned to further inform use of mAFP in AMI-CS; RECOVER IV (The RECOVER IV Trial) was discontinued after publication of DanGer Shock. Similarly, whether other MCS modalities such as VA-ECMO, which had no survival benefit when applied broadly, would be beneficial when applied to patients similar to DanGer Shock remains unclear.[14] Further, whether VA-ECMO in combination with other MCS modalities has benefit is unknown.

The high adverse event rate with mAFPs has important implications for practice and systems of care. Physicians and critical care teams must develop expertise in mAFP management to mitigate risks and optimize benefit. Data from a regional U.S. STEMI network showed that centers treating a median of 23 patients per year meet DanGer Shock criteria.[15] With such low incidence, some suggest a role for hub-and-spoke models where mAFPs could be initiated at a spoke hospital to provide immediate hemodynamic stabilization with subsequent transfer to a hub hospital for postinsertion device management and advanced therapies.[16] Future implementation-based research should evaluate outcomes and develop best practices for this strategy.

SUMMARY AND ROAD AHEAD

The 2025 ACS guideline, in its reliance on 4 landmark RCTs in AMI-CS, has codified several sweeping changes in recommendations for MCS use that should influence practice and improve care for these high-risk patients. Whereas IABP use is expected to decrease, use of mAFPs is likely to increase but should be judicious, with caution against overgeneralizing given the narrow selection criteria of DanGer Shock. Evaluating real-world practice patterns and outcomes of patients with AMI-CS based on these recommendations will be paramount.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Murugiah has received support from the National Heart, Lung, and Blood Institute of the National Institutes of Health (under award K08HL157727). Dr Cohen has received institutional research grants from Edwards Lifesciences, Abbott, and Boston Scientific; and has received consulting income from Edwards Lifesciences, Abbott, Boston Scientific, and Medtronic. Dr Dhruva has received research funding from the Department of Veterans Affairs and Arnold Ventures; and has served as a member of the Institute for Clinical and Economic Review California Technology Assessment Forum and on the Medicare Evidence Development and Coverage Advisory Committee. Dr McDonagh has reported that she has no relationships relevant to the contents of this paper to disclose.

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KEY WORDS acute coronary syndrome, cardiogenic shock, guidelines, mechanical circulatory support, myocardial infarction